Garbage Management System

A PROJECT REPORT

submitted by

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in partial fulfillment for the award

of

Bachelor of Science

degree in

Computer Science

School of Computer Science and Engineering

VIT®

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(Estd. u/s 3 of UGC Act 1956)

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School of Computer Science and Engineering

DECLARATION

I/We hereby declare that the project entitled **"Garbage Management system"** submitted by me/us to the School of Computing Science and Engineering, VIT University, Vellore-14 in partial fulfillment of the requirements for the award of the degree of **Bachelor of science in Computer Science** is a record of bonafide work carried out by me/us under the supervision of **Bhulakshmi Bonthu, Assistant Professor, SCOPE.** I further declare that the work reported in this project has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma of this institute or of any other institute or university.

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ACKNOWLEDGEMENT

We would like to take this opportunity to extend our deepest gratitude to our project guide, **Professor Bhulakshmi Bonthu**. for her constant guidance throughout the duration of our project. We would also wish to acknowledge our head of the department or Program Chair, **Professor Anuradha J**. for her never ending support and **Dr. Arun Kumar Thangavelu** the Dean, SCOPE for giving us the opportunity to gain practical knowledge of working on a real life project. Finally, we would like to thank VIT University, all our professors, fellow students and friends for providing us with the necessary resources and motivation to carry out our work. It was their constant encouragement and support that helped us to complete our project successfully.

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ABSTRACT :

In the present day scenario, many times we see that the garbage bins or Dust bin are placed at public. Places in the cities are overflowing due to increase in the waste every day. It creates unhygienic condition for the people and creates bad smell around the surroundings this leads in spreading some deadly diseases & human illness, to avoid such a situation we are planning to design “IoT Based Garbage and Waste Management for Smart Cities”.

It will implement a smarter way of conventional waste management using smart sensors to gather fill-level data, presence of garbage around the dustbin and stinking condition from

Containers and garbage bins, and send it to servers in real time. An authorized phone number which are present in Waste Management Centres gather fill-level and other information sent from multiple containers which are situated throughout a city/ locality. The data acquired as above, can be used to systematically plan route-map to collect garbage. The information from bins to the authorized number is sent using communicating modules (GSM/GPRS module).

The entire operation is controlled using Atmega328P 8-bit microcontroller. This report showcases a potential design for an IoT gateway that can be used to provide a framework for a smart waste management system. Aurdino Uno board which is interfaced with GSM modem and Ultrasonic sensor. Ultrasonic sensor is placed at the top of the dustbin which will measure the stature of the dustbin. The threshold stature is set as 10cm. Aurdino will be programmed in such a way that when the dustbin is being filled, the remaining height from the threshold height will be displayed. Once the garbage reaches the threshold level ultrasonic sensor will trigger the GSM modem which will continuously alert the required authority until the garbage in the dustbin is squashed. Once the dustbin is squashed, people can reuse the dustbin. At regular intervals dustbin will be squashed.

1 INTRODUCTION

Most of the urban cities and town in India are not well designed to facilitate the proper garbage disposing and collection mechanism. Also the cities are expanding rapidly putting the pressure on existing infrastructure which is not expanding at the same pace that of urbanization “Cleanliness is next to godliness” is said and believed from the centuries. In this era of environmental concern individuals are outwardly interested in the healthy state of their surroundings. Whether it may a small home of four members or locality cleanliness is of equal importance. India being a huge and highly populated nation, effective waste management is the major concern in maintaining the health and hygiene of the people. Convectional waste management systems which are currently employed in India have static routes and schedules where garbage from containers are collected on fixed schedules, regardless if they are full or not. This type of situation is often seen where dustbin is not addressed even if it is filled and garbage is spread on open streets. This severely affects the health and hygiene of the people. The technology can be simply explained as a connection between humans-computers-things. All the equipment’s we use in our day to day life can be controlled and monitored using the IoT. Smart collection bin works in the similar manner with the combination of sensors.

1.1 Motivation

India with clean households has dirty streets, people find themselves lazy to throw away waste to garbage bins rather dispose waste in open. The county dreaming of smart cities not only has to have concern on electric power management, vehicle traffic and pollution management, water supply and management but also has to have a greater deal on waste collection –segregation –transport –disposal and complete control and management of these .

Collection Hence it is highly essential to keep track on fill levels of garbage bins, intelligently plan collection routes, and optimize human and machine numbers and their work efficiency. Data-analysis done on information gathered in servers can be used for proper control, policy making and budget planning for maintenance of the complete system. This can very well be accomplished by the data gathered by the

servers sent by smart sensors based on route-maps planned on data gathered, reduces collection costs, vehicle count on task, emissions, road and vehicle wear, noise pollution. It also significantly reduces work hours and human resource assigned, which is a big saving in organization's budget. Both solutions which are proposed above in abstract are unique and efficient in complete waste management of a city/ locality, which as for maintenance of cleanliness and hygiene of city and also in proper waste management.

1.2 Aim of the proposed Work

Considering the need of modern technology the smart garbage bin can expensive but considering the amount of dustbin needed in India, expensive garbage bin would not be a prior experiment that is why we have decide to use based sensors to reduce its cost and also make it efficient in applications.

1.3 Background Research

One important step in building a new Smart Dustbin was to know the existing systems for waste management. This section consists of some systems which were proposed for waste management from different researchers and students all over the world.

Existing system : In 'smart garbage management system' system, the level of garbage in the dustbins is detected with the help of Sensor systems, and communicated to the authorized control room through GSM system. Microcontroller is used to interface the sensor system with GSM system. A GUI is also developed to monitor the desired information related to the garbage for different selected locations. This will help to manage the garbage collection efficiently. Here in this system, Infrared (IR) sensor is used for garbage level detection. IR sensor radiates light which is invisible to the human eye because it is at infrared wavelengths, but it can be detected by electronic devices. GSM module is used for communication purpose, to send message to the control room when the container is full. Arduino board is used to interface the sensor and GSM module.

1.4 Related work

The GSM (Global System for Mobile Communication) and Arduino Uno is used to form the Integrated system to monitor the waste bins remotely. The sensors are placed in the common garbage bins placed at the public places. When the garbage reaches the level of the sensor, then that indication will be given to ARM 7 Controller. The controller will give indication to the driver of garbage collection truck as to which garbage bin is completely filled and needs urgent attention. ARM 7 will give indication by sending SMS using GSM technology.

A. The authors in [1] have made a quantitative analysis between existing dustbins and their serving population. The study first analyses the spatial distribution of dustbins in some areas of Dhaka city using average nearest neighbour functions of GIS. Remarkably, the spatial circulation of the current dustbins has appeared to be dominatingly in clustered pattern. Next, an optimal number of additional dustbins were calculated. It is shown that the number of existing dustbins is insufficient in the studyarea.

The extent of pollution caused by the existing dustbins was calculated using spatial analyst functions of GIS. It is found that all the dustbins are burnt with wastes and causing pollution to the environment. The results thus obtained would help to understand the present situation of the waste management of Dhaka city and to optimally place the required number of dustbins to prevent further pollution to environment.

B. An IoT-based smart garbage system (SGS) is proposed to reduce the amount of food waste by the authors in [3]. In an SGS, battery-based smart garbage bins (SGBs) exchange information with each other using wireless mesh networks, and a router and server collect and analyze the information for service provisioning. Furthermore, the SGS includes various IoT skills considering user convenience and increases the battery lifetime through two types of energy-efficient operations of the SGBs: stand-alone operation and cooperation- based operation. The proposed SGS had been functioned as a pilot project in Gangnam district, Seoul, Republic of Korea, for a one-year period. The test demonstrated that the normal measure of food waste could be decreased by 33%.

C. The authors in [2] have equipped the smart bins with ultrasonic sensors which measure the level of dustbin being filled up. The container is divided into three levels of garbage being collected in it. Every time the garbage crosses a level the sensors receives the data of the filled level. This data is further sent to the garbage analyzer as instant message using GSM module.

Placing three ultrasonic sensors at three different levels of the container may be a disadvantage as the cost of the dustbin increases due to the sensors and also the sensors can be damaged due to the rough action by the users.

D. The authors in [4] has built a framework in which a Camera will be set at each garbage collection point alongside load cell sensor at base of the trash can. The camera will take continuous snapshots of the garbage can. A threshold level is set which compares the output of camera and load sensor.

The comparison is done with help of microcontroller. After analyzing the image an idea about level of garbage in the can and from the load cell sensor, weight of garbage can be known. Accordingly information is processed that is controller checks if the threshold level is exceeded or not. This is convenient to use but economically not reliable.

1.5 System Requirements

1.5.1 HARDWARE Requirements

- Arduino uno (ATmega328P)
- Ultrasonic sensors (HC-SR04)
- GSM 900 module (with a sim card)
- Mobile phone (any phone will work)
- Bread board
- Connecting wires (male to male , male to female)

1.5.2 SOFTWARE Requirements:-

- Arduino IDE

2. Overview of the Proposed System:-

2.1 Introduction of problem and its related concepts

Smart dustbins is a new idea of implementation which makes a normal dustbin smart using sensors for garbage level detection and sending message to the user updating the status of the bin. As soon as the dustbin is full it moves in the predefined path to reach the larger container with the help of motors and wheels. The system design and implementation are explained in detail in further in the paper.

2.2. Gaps identified from the existing systems

- Time consuming and less effective: trucks go and empty containers whether they are full or not.
- High costs.
- Unhygienic Environment and look of the city.
- Bad smell spreads and may cause illness to human beings.
- More traffic and Noise.

2.3 Proposed solution

Smart dustbins is a new idea of implementation which makes a normal dustbin smart using sensors for garbage level detection and sending message to the user updating the status of the bin. As soon as the dustbin is full it moves in the predefined path to reach the larger container with the help of motors and wheels. The system design and implementation are explained in detail in further in the paper.

- Real time information on the fill level of the dustbin.
- Deployment of dustbin based on the actual needs.
- Cost Reduction and resource optimization.
- Improves Environment quality
  - -Fewer smells
  - -Cleaner cities
- Intelligent management of the services in the city.

- Effective usage of dustbins.

2.4 Methodology Adapted

In this paper, GSM 800C modem is used to send the messages. It consists of a GSM/GPRS modem with standard communication interfaces like RS-232 (Serial Port), USB, so that it can be easily connected to the other devices. The ultrasonic sensor is used to find the height of garbage filled at different intervals of time.

However, three sensors can be employed at various heights like h/3, 2h/3 and h, where h is the height of the bin but to make it affordable and to achieve the same results, only one sensor is placed at surface level.

Arduino Uno board is used as micro-controller platform. Interfacing is done between GSM modem and Arduino board by connecting RX pin of modem to TX pin of board and vice- versa.

ECHO and TRIGGER pins of sensor is connected to digital pins 5 and 13 of Arduino board. Arduino board works at 5V power supply and GSM modem requires 2A to power on.

Threshold height is set to 10cm.Threshold distance is the difference in height at which sensor is placed and the level of garbage fill. During the course of garbage accumulation, whenever the difference falls below threshold value, GSM modem is activated to send an alert signal to the concerned authority through an SMS.

As soon as an SMS alert is received, concerned authority can place orders to the workers for cleaning the filled bins on time without allowing them to overflow.

Expected Results :

1. Reducing human time and effort

2. Providing a smart technology for waste system.

3. Avoiding human intervention.

4. Monitoring the waste management.

5. Resulting in healthy and waste ridden environment.

Various features such as durability, affordability, prevention against damage and maintenance issues are addressed when these smart dustbins are designed. This Smart Dustbin can contribute a lot towards clean and hygienic environment in building a smart city.But since the technology is new in India, proper awareness should be created among the public before it is implemented on a large scale. Otherwise, sensitive devices like sensors might be damaged due to rough action of the users

3. System Design

3.1 Proposed System

Considering the need of modern technology the smart garbage bin can expensive but considering the amount of dustbin needed in India, expensive garbage bin would not be a prior experiment that is why we have decide to use based sensors to reduce its cost and also make it efficient in applications**.**

3.2 Design

Smart bin is built on Arduino board platform. It is interfaced with a GSM modem (SIM 900A) and the bin is equipped with Ultrasonic sensor (HC-SR04).

3.2.1 Block Diagram of the System

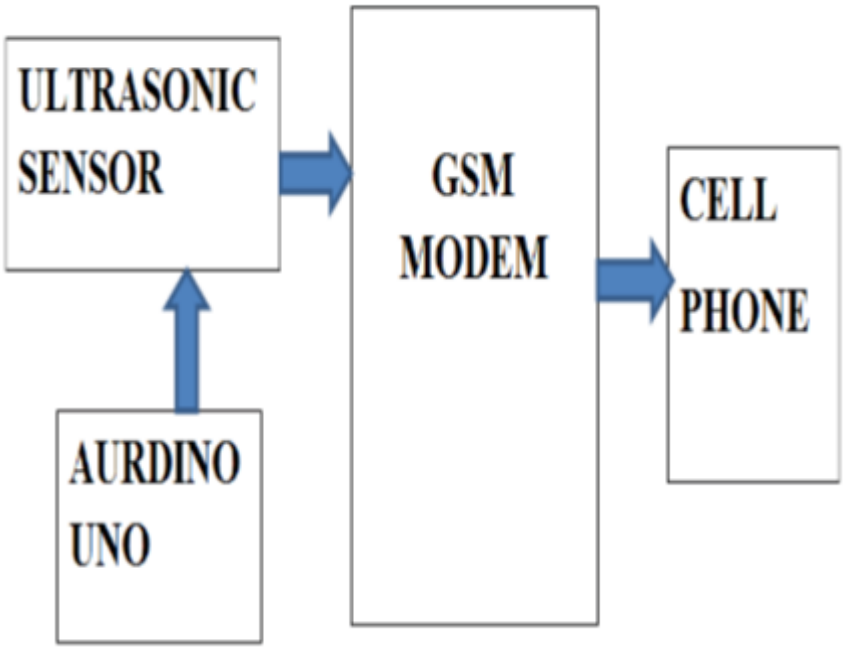

Fig 3.1 : Block Diagram of system

3.3 Discussion of Alternative Designs :

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3.4 System Architectural Design :

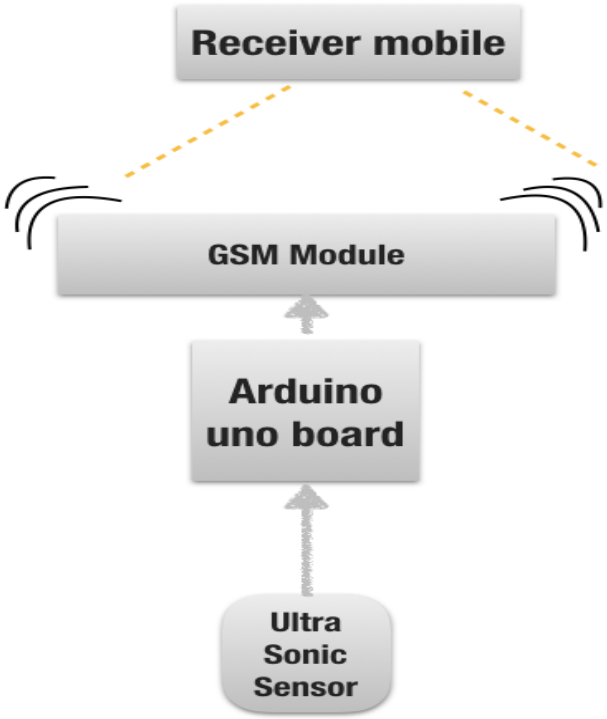


Fig 3.2 : System Architecture

3.5 Components used

3.5.1 ULTRASONIC SENSOR

The ultrasonic sensor has two pins: Trigger and Echo, which are used for calculating the distance of the object by generating sound waves and thus calculating the time duration of the echo that is generated.

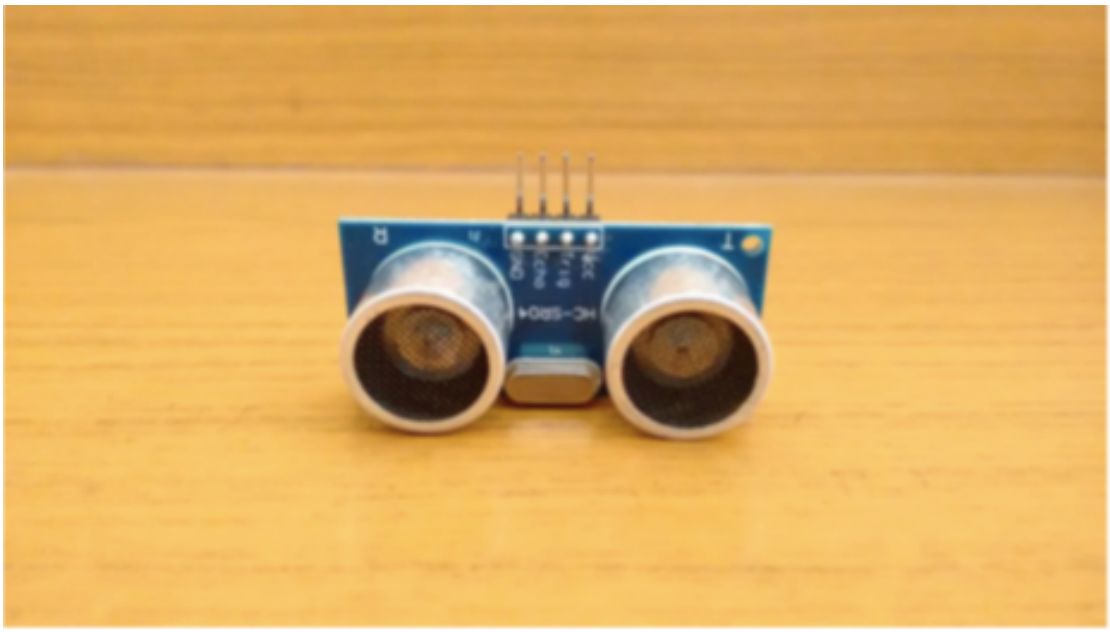


Fig 3.3: Ultrasonic Sensor

3.5.2 GSM MODULE

SIM800C is a quad-band GSM/GPRS module that works on frequencies GSM850MHz, EGSM900MHz, DCS1800MHz and PCS1900MHz. SIM800C features GPRS multi-slot class10/class12 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

With a tiny configuration of 17.6*15.7*2.3mm, SIM800C can meet almost all the space requirements in customers' applications, such as smart phone, PDA and other mobile devices.

SIM800C is a SMT package with 42 pads, and provides all hardware interfaces between the module and customers' boards.

- One 3 lines serial port and one full modem serial port;

- One USB, the USB interface can debug, download software;
- One audio channel which include a microphone input and a speaker output;
- Programmable general purpose input and output;
- One SIM card interface;
- Support Bluetooth (need software support).

SIM800C is designed with power saving technique so that the current consumption is as low as 0.6mA in sleep mode.

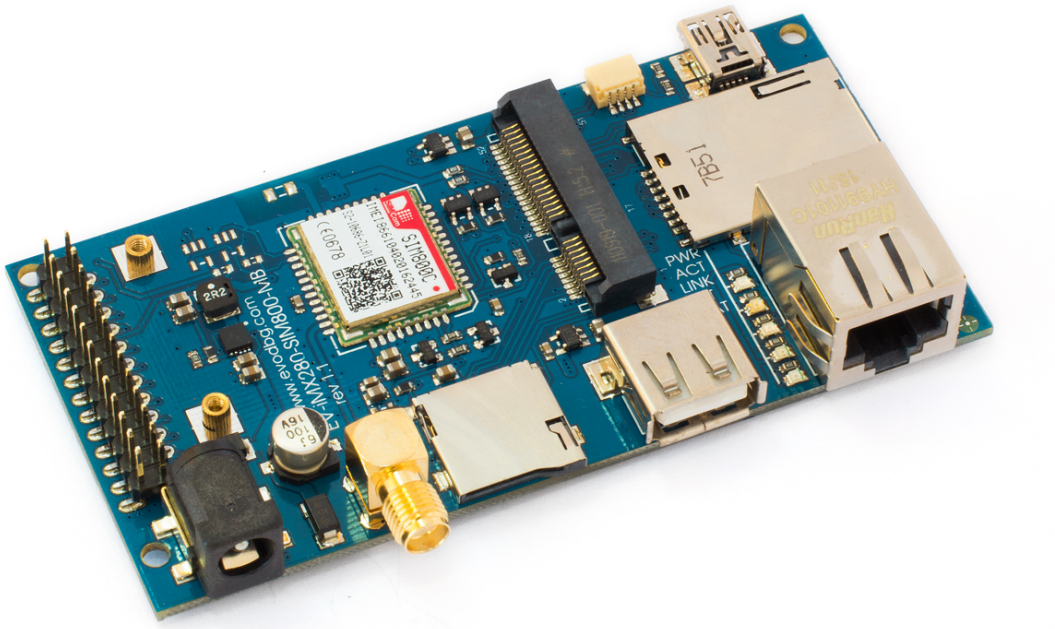


Fig 3.4 : GSM module (SIM800C)

Specifications of GSM/GPRS Quad band TTL UART modem(SIM800C):

- High Quality Product (Not hobby grade)
- Quad-band 850/900/1800/1900MHz
- Make and receive voice calls, Send and receive SMS messages
- Send and receive GPRS data (TCP/IP, HTTP, etc.)
- Bluetooth connectivity, option for chip antenna
- Configurable Baud rate (9600-115200, factory default value: 9600)

- AT command interface
- Input Voltage : 5-12 V
- Micro sim card socket
- Network, Status and Power indication LEDs
- Network, modem status,CTS/RI and RTS/RFSYNC can be taken via RMC connector
- RMC connector for TTL UART interface and power
- On board SMA connector and UFL connector
- Option for audio interface
- Normal operation temperature: -20 °C to +55 °C
- Provision for firmware updation
- Power key ON/OFF for SIM800C
- VRTC pin provided for CMOS battery backup
- 5 V Vin can be taken as V Interface by PCB solder jumper
- CTS/RI as well as RTS/RFSYNC can be chosen via PCB solder jumper.

3.5.3 ARDUINO BOARD

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

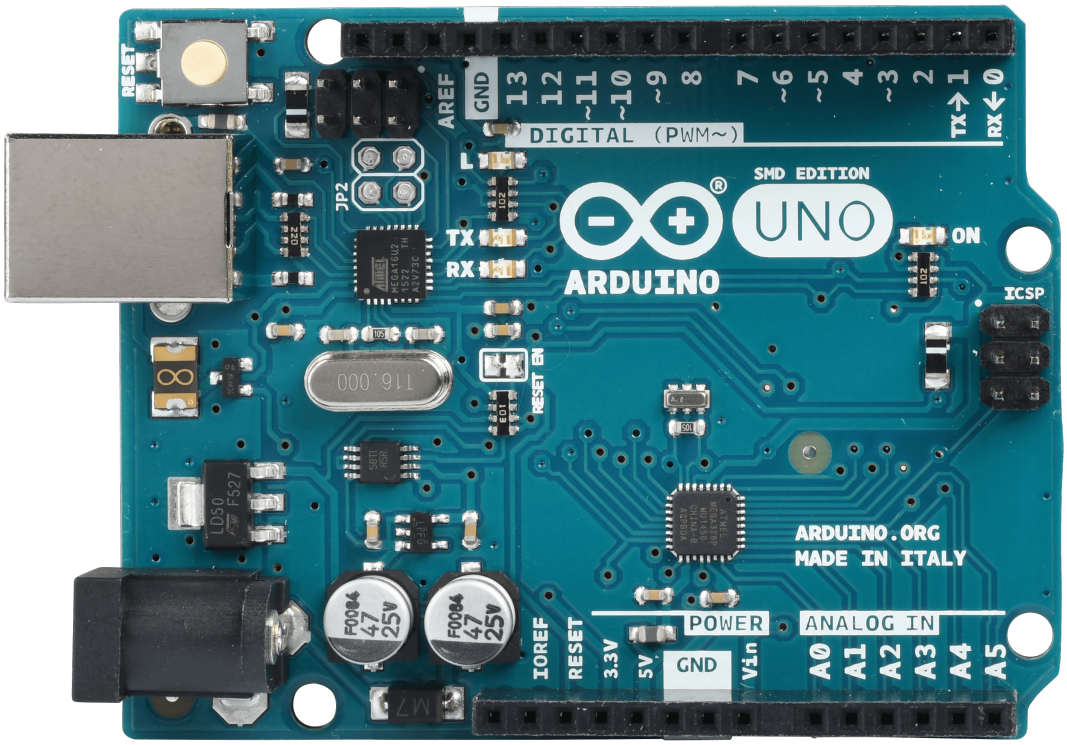


Fig 3.5 : Arduino Uno

INPUT/OUTPUT

See the mapping between Arduino pins and ATmega328P ports. The mapping for the ATmega8, 168, and 328 is identical.Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

In addition, some pins have specialized functions :

- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.
- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.
- LED: 13. There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function.

There are a couple of other pins on the board:

- AREF. Reference voltage for the analog inputs. Used with analogReference().
- Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

3.5.4 BREAD BOARD

A breadboard is a construction base for prototyping of electronics. Originally it was literally a bread board, a polished piece of wood used for slicing bread. In the 1970s the solderless breadboard (AKA plug board, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these. "Breadboard" is also a synonym for "prototype". Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating

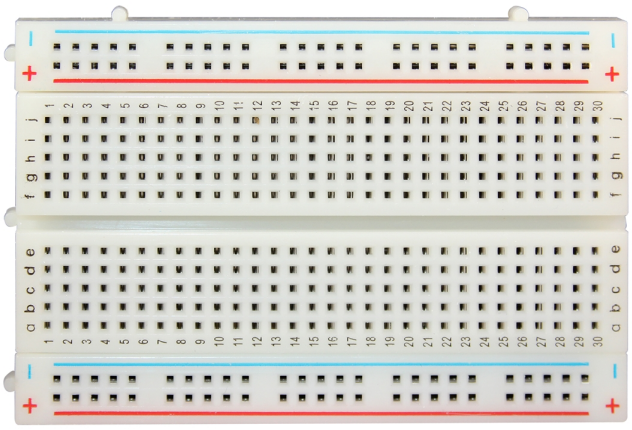


Fig 3.6 : Bread Board

temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also extremely popular with students and in technological education. Older breadboard types did not have this property. A stripboard (veroboard) and similar prototyping printed circuit boards, which are used to build semi- permanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs). A modern solderless breadboard consists of a perforated block of plastic with numerous tin plated phosphor bronze or nickel silver alloy spring clips under the perforations. The clips are often called tie points or contact points. The number of tie points is often given in the specification of the breadboard. The spacing between the clips (lead pitch) is typically 0.1 in (2.54 mm). Integrated circuits (ICs) in dual in-line packages (DIPs)

can be inserted to straddle the centerline of the block. Interconnecting wires and the leads of discrete components (such as capacitors, resistors, and inductors) can be inserted into the remaining free holes to complete the circuit. Where ICs are not used, discrete components and connecting wires may use any of the holes.

3.5.5 JUMP WIRES

Jump wires (also called jumper wires) for solderless breadboarding can be obtained in ready-to-use jump wire sets or can be manually manufactured. The latter can become tedious work for larger circuits. Ready- to-use jump wires come in different qualities, some even with tiny plugs attached to the wire ends. Jump wire material for ready-made or homemade wires should usually be 22 AWG (0.33 mm2) solid copper, tin-plated wire - assuming no tiny plugs are to be attached to the wire ends. The wire ends should be stripped 3⁄16 to 5⁄16 in (4.8 to 7.9 mm). Shorter stripped wires might result in bad contact with the board's spring clips (insulation being caught in the springs).

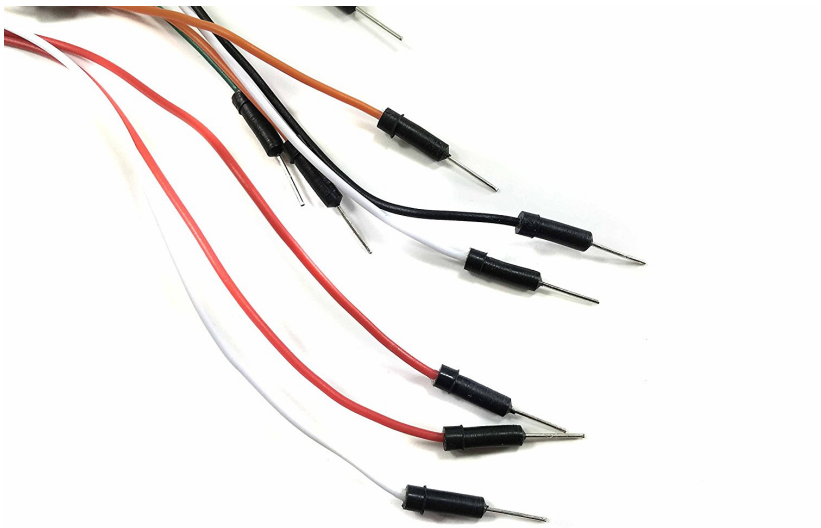


Fig 3.7: Jump Wires

Longer stripped wires increase the likelihood of short-circuits on the board. Needle-nose pliers and tweezers are helpful when inserting or removing wires, particularly on crowded boards. Differently colored wires and color-coding discipline are often adhered to for consistency. However, the number of available colors is typically far fewer than the number of signal types or paths. Typically, a few wire colors are reserved for the supply voltages and ground (e.g., red, blue, black), some are reserved for main signals, and the rest are simply used where convenient.

4. Implementation

4.1 Tools Used (ARDUINO IDE)

4.1.1 Introduction

In this project, as we are using Arduino so to dump the code in to the Arduino, we are using Arduino IDE tool.

4.1.2 Arduino IDE

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the **GNU toolchain**, also included with the IDE distribution. The Arduino IDE employs the program *avrdude* to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

4.1.3 Reason for selecting tool

As we are using Arduino Uno processor, to dump the code we have to use the Arduino IDE tool.

4.2 Implementation

The garbage containers transmit signals to indicate that they are over 80% or 90% full and should be emptied. Via the mobile communications network, the signals are sent to a web based software application used by the waste management company.

In the software, the capacity of the container is indicated, which is taken as a basis to plan the best route for waste collection garbage trucks travel only to those containers that actually need to be emptied. A robust ultrasonic sensor is installed in the garbage container and detects the fill level regardless of what has been deposited inside. The whole system contains **ULTRASONIC-SENSOR, ARDUINO BOARD, GSM MODULE, BREAD BOARD,**

POWER SUPPLY (USB). The sensor is fixed on to the bread board. the connection between the arduino board and sensor is made with the help of connecting wires. The working program is fed into the arduino board. The gsm module is also connected to the same arduino board with the help of wires. The power supply to the system is given with the help of a battery.

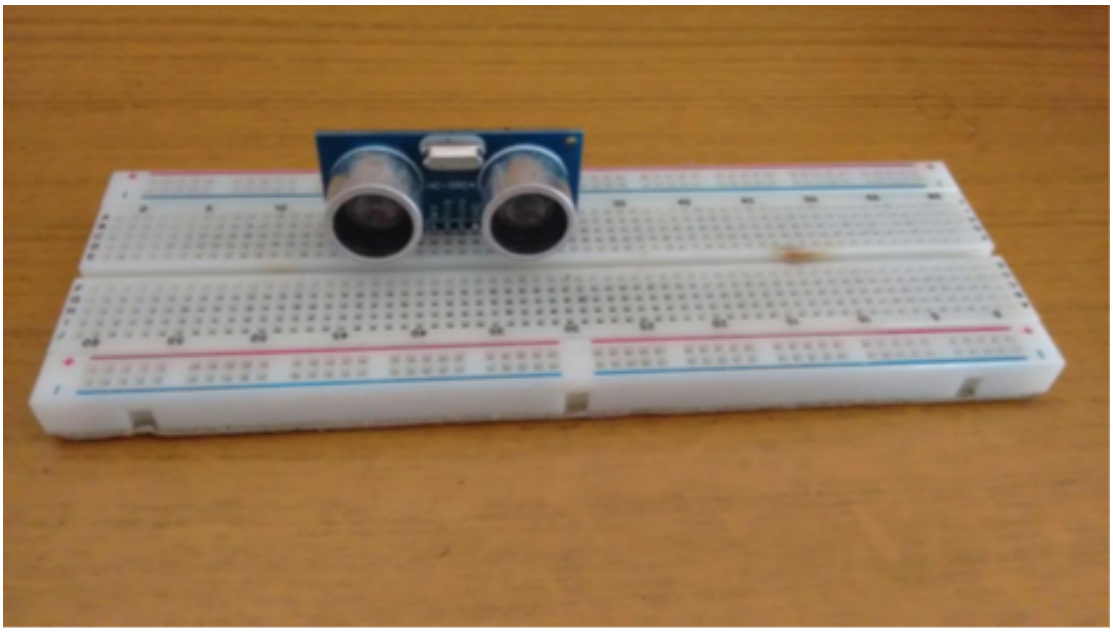


FIG 4.1 : ULTRASONIC SENSOR IS INSERTED IN BREAD BOARD

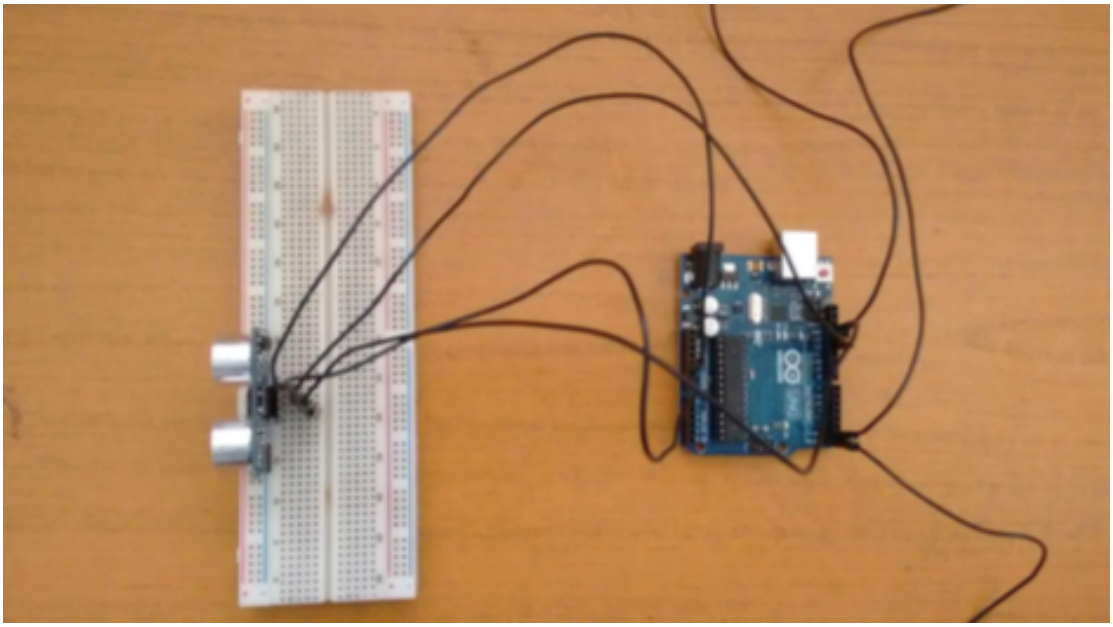


FIG 4.2 : ULTRASONIC SENSOR IS CONNECTED WITH ARDUINO BOARD THROUGH JUMP WIRES (THIS SETUP WILL HELP IN SENSING OF THE GARBAGE LEVEL)

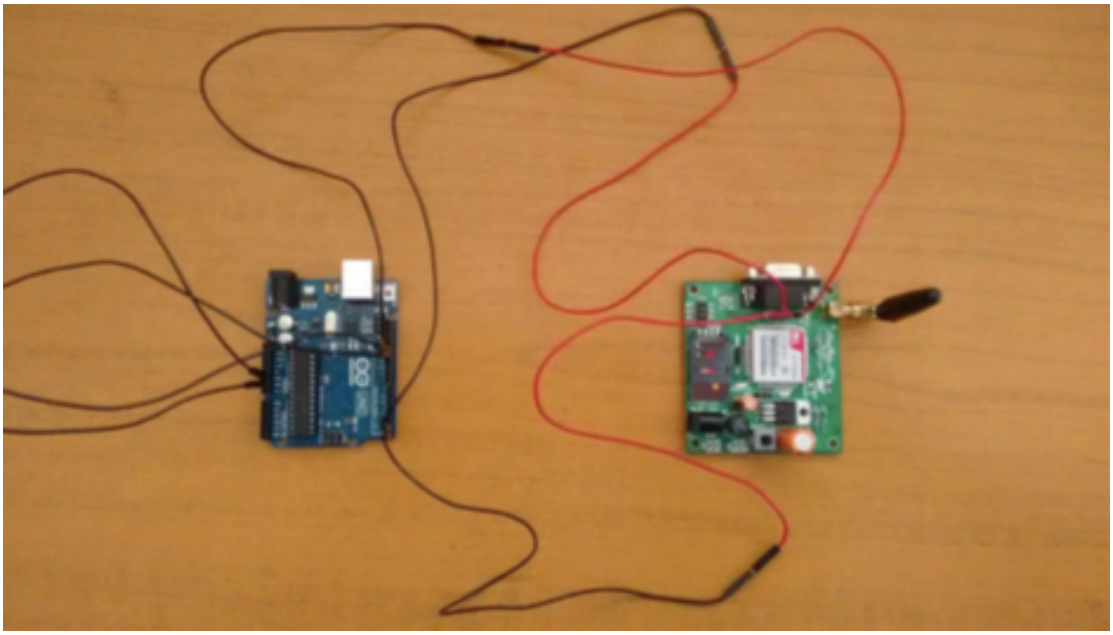


FIG 4.3 : GSM MODULE IS CONNECTED WITH ARDUINO BOARD THROUGH JUMP WIRES (THIS SETUP WILL HELP IN SENDING OF THE MESSEGE FROM DUSTBIN TO MUNICIPAL CORPORATION)

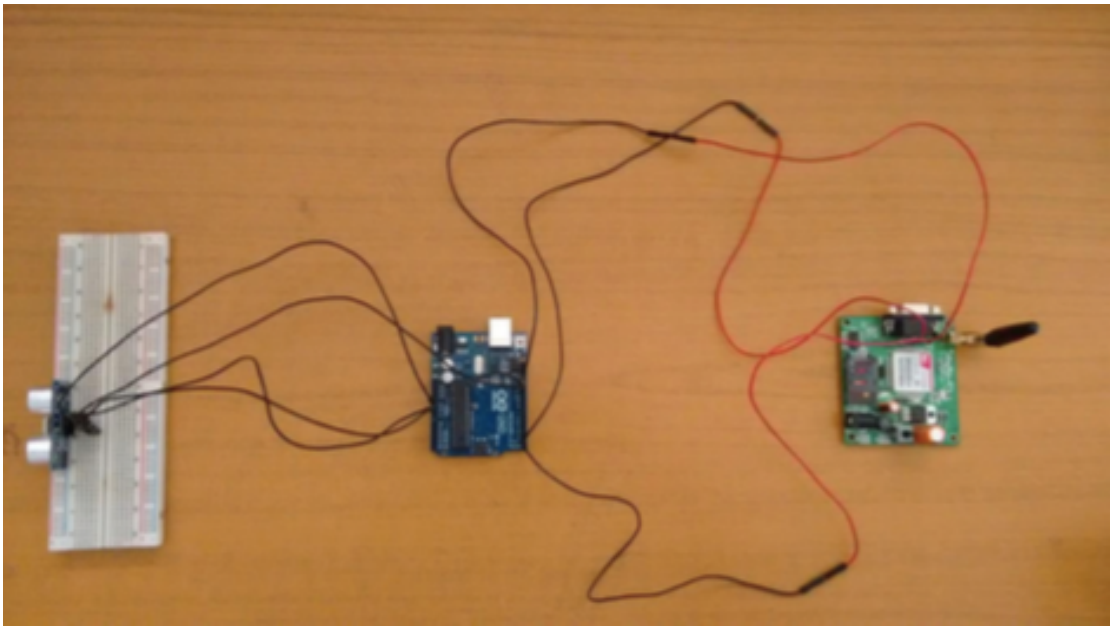


FIG 4.4 : COMBINED SETUP OF ULTRASONIC SENSOR, ARDUINO BOARD, BREAD BOARD AND GSM MODULE CONNECTED WITH JUMP WIRES

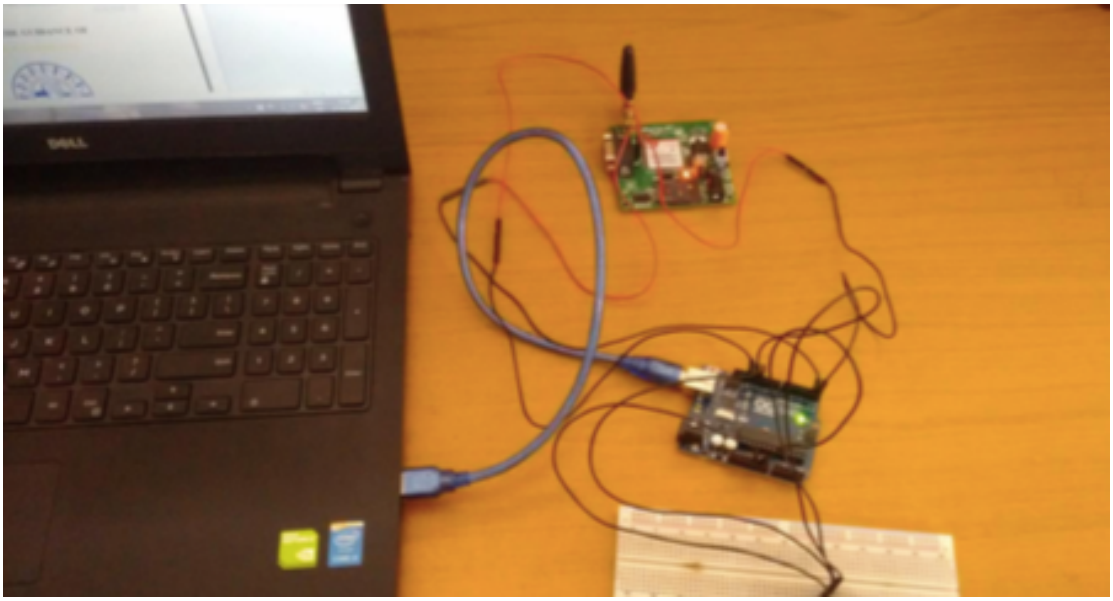


FIG 4.5 : ARDUINO BOARD IS CONNECTED WITH LAPTOP THROUGH DATA CABLE FOR DUMPING OF PROGRAM

4.3 Code

```
#include <SoftwareSerial.h>

#define LED 13

SoftwareSerial mySerial(7,8);

int trigger=13;

int echo=11;

float pingTime, targetDistance, speedOfSound=343;

void setup()

{

  // put your setup code here, to run once:

  pinMode(trigger,OUTPUT);
```

```
  pinMode(echo,INPUT);
  Serial.begin(9600);
  mySerial.begin(9600);
  //boolean notConnected = true;
}

float getDistance()
{
  pingTime = pulseIn(echo,HIGH);
  pingTime = pingTime/1000000;
  targetDistance = ((speedOfSound * pingTime)/2);
  return targetDistance;
}
void loop()
{
  float totaldistance;
  digitalWrite(trigger,LOW);
  delayMicroseconds(2000);
  digitalWrite(trigger,HIGH);
  delayMicroseconds(15);
```

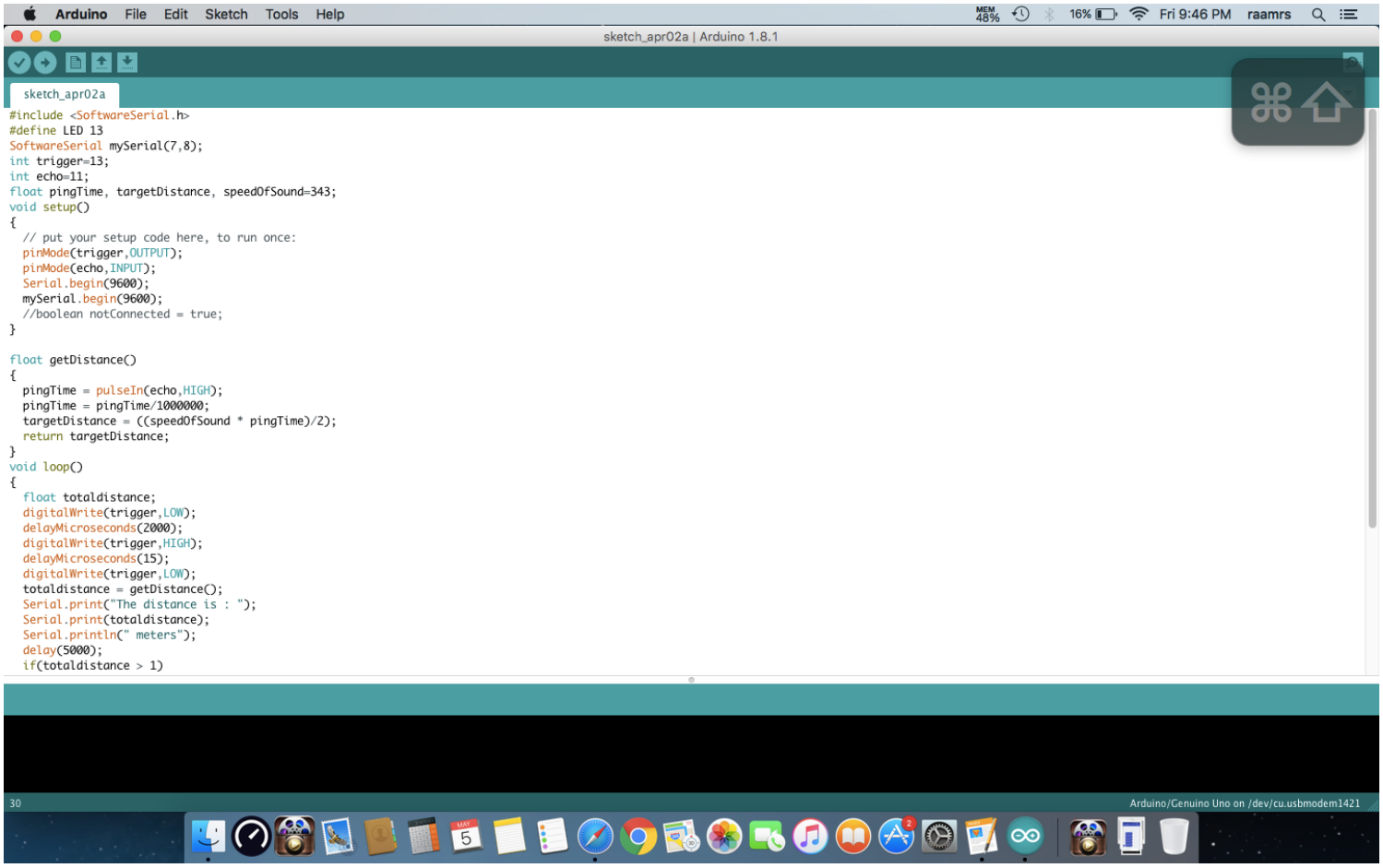
```
  digitalWrite(trigger,LOW);
  totaldistance = getDistance();
  Serial.print("The distance is : ");
  Serial.print(totaldistance);
  Serial.println(" meters");
  delay(5000);
  if(totaldistance > 1)
  {
    Serial.println("garbage is full");
     mySerial.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
    delay(500);  // Delay of 1000 milli seconds or 1 second
       mySerial.println("AT+CMGS=\"+918870855099\"\r"); // Replace x with mobile number
    delay(1000);
    mySerial.println("Garbage is full!!!");
    delay(100);
    mySerial.println((char)26);// ASCII code of CTRL+Z
    delay(1000);
   delay(5000);
  }
}
```

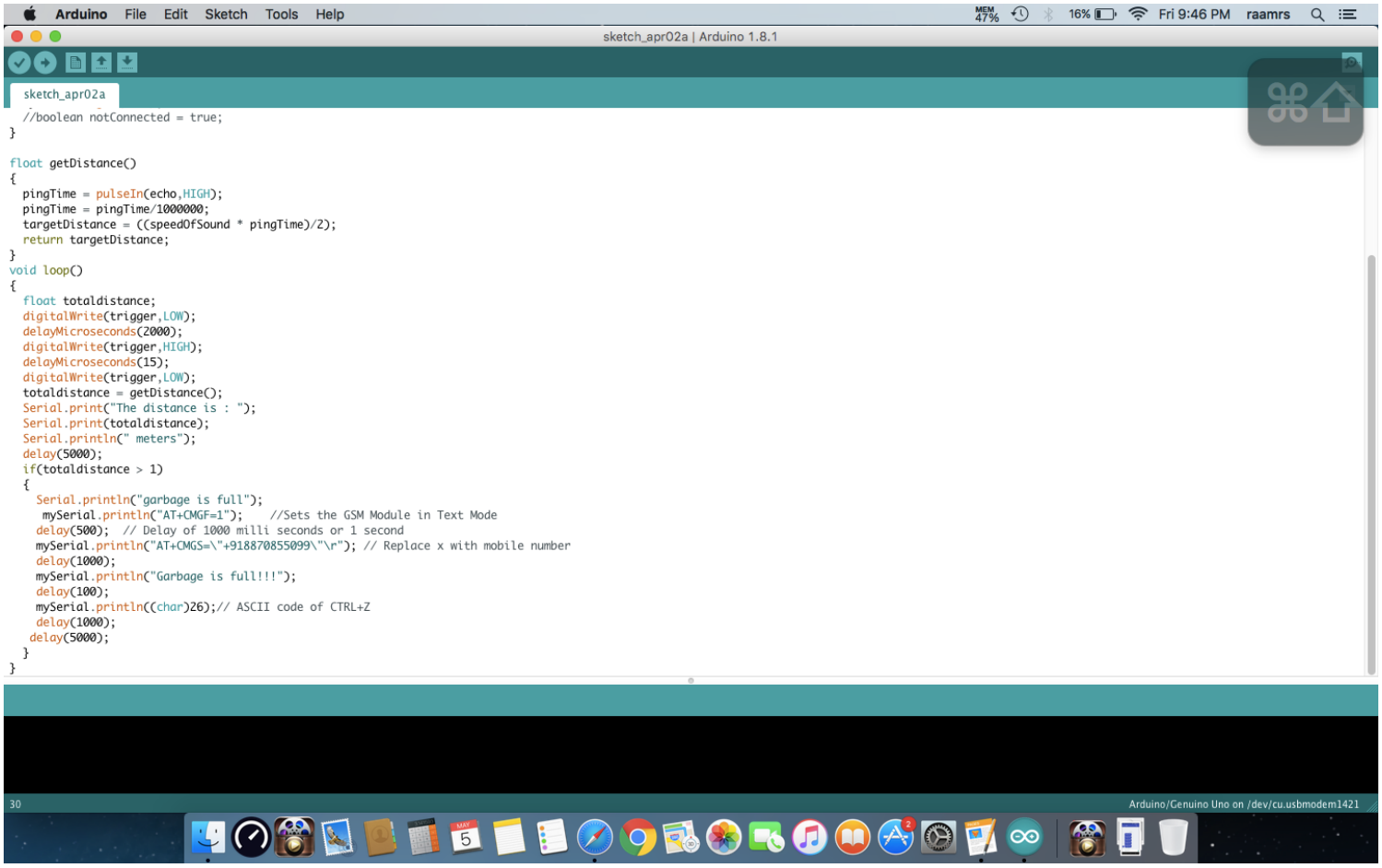
5. Results and Discussion

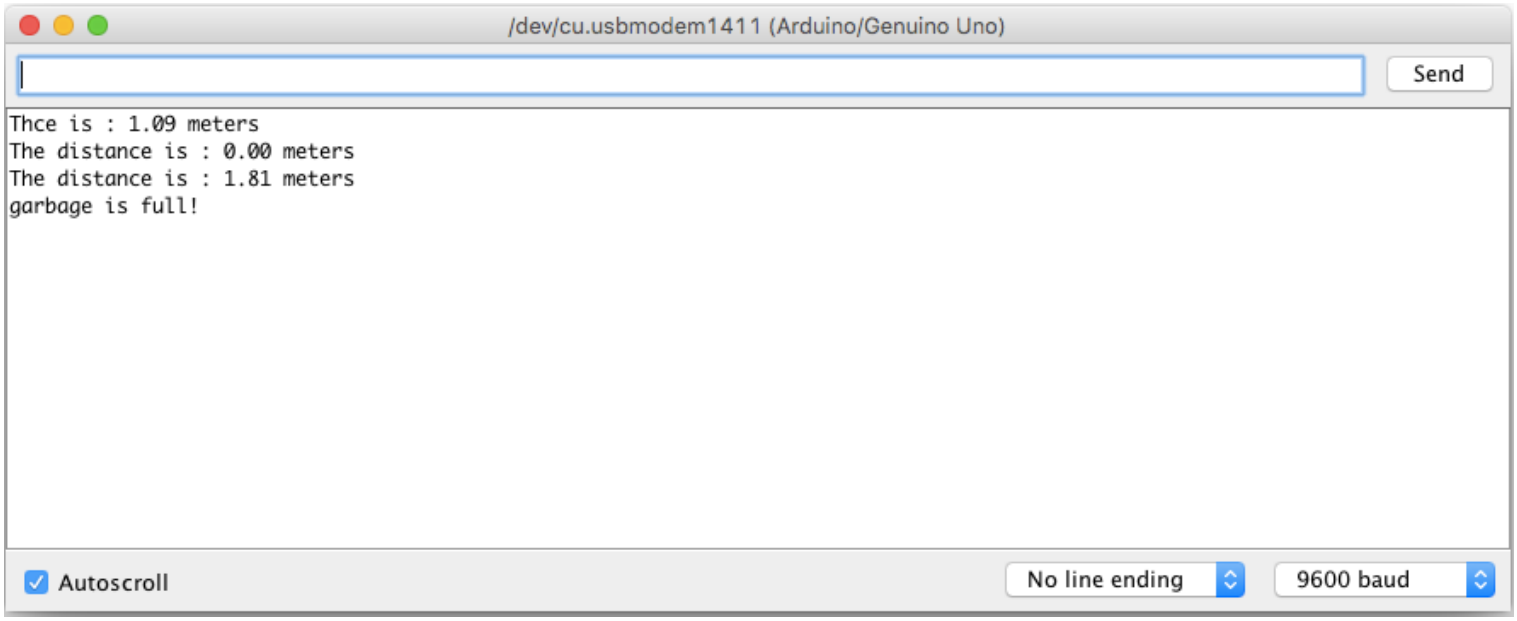
5.1 Results

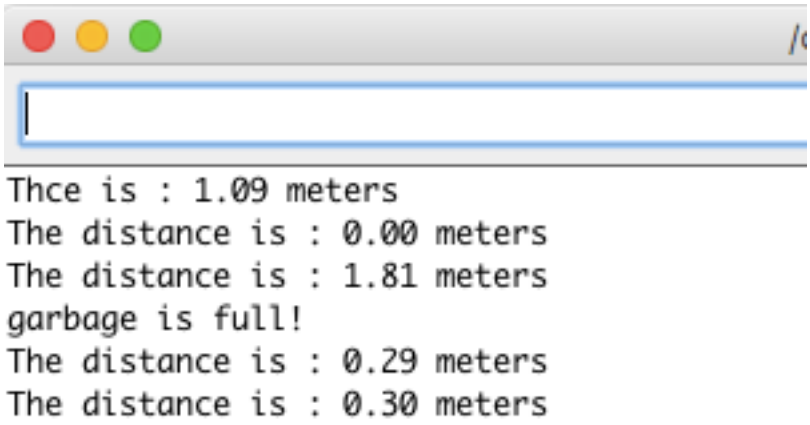
Considering the dustbin height as 1.2 meter, the threshold limit of ultrasonic sensor is gives as 1 meter. whenever the ultrasonic sensor gives the height of the garbage level, if the height is equal to or more than 1 meter then the arduino is programmed to send the message to the concerned authorities mobile through SIM in GSM module.

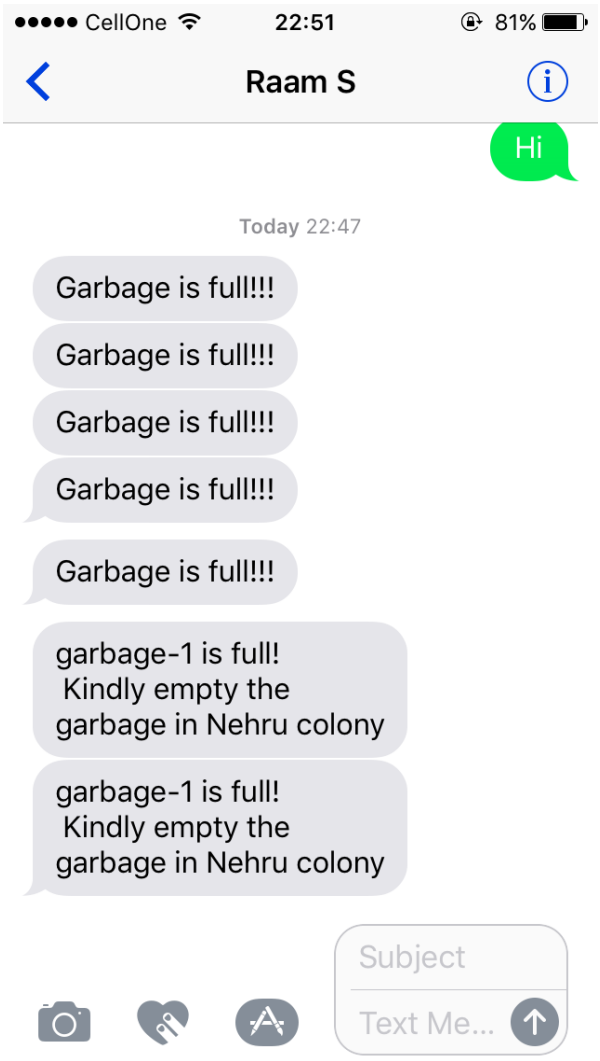
5.2 Screenshots




Arduino File Edit Sketch Tools Help
Fri 9:46 PM raamrs
sketch_apr02a | Arduino 1.8.1
sketch_apr02a
//boolean notConnected = true;
}
float getDistance()
{
pingTime = pulseIn(echo,HIGH);
pingTime = pingTime/1000000;
targetDistance = ((speedOfSound * pingTime)/2);
return targetDistance;
}
void loop()
{
float totaldistance;
digitalWrite(trigger,LOW);
delayMicroseconds(2000);
digitalWrite(trigger,HIGH);
delayMicroseconds(15);
digitalWrite(trigger,LOW);
totaldistance = getDistance();
Serial.print("The distance is : ");
Serial.print(totaldistance);
Serial.println(" meters");
delay(5000);
if(totaldistance > 1)
{
Serial.println("garbage is full");
mySerial.println("AT+CMGF=1"); //Sets the GSM Module in Text Mode
delay(500); // Delay of 1000 milli seconds or 1 second
mySerial.println("AT+CMGS=\"+918870855099\"\r"); // Replace x with mobile number
delay(1000);
mySerial.println("Garbage is full!!!");
delay(100);
mySerial.println((char)26);// ASCII code of CTRL+Z
delay(1000);
delay(5000);
}
}
30
Arduino/Genuino Uno on /dev/cu.usbmodem1421


/dev/cu.usbmodem1411 (Arduino/Genuino Uno)
Send
Thce is : 1.09 meters
The distance is : 0.00 meters
The distance is : 1.81 meters
garbage is full!
Autoscroll
No line ending
9600 baud


Thce is : 1.09 meters
The distance is : 0.00 meters
The distance is : 1.81 meters
garbage is full!
The distance is : 0.29 meters
The distance is : 0.30 meters


CellOne
22:51
81%
Raam S
Hi
Today 22:47
Garbage is full!!!
Garbage is full!!!
Garbage is full!!!
Garbage is full!!!
Garbage is full!!!
garbage-1 is full!
Kindly empty the
garbage in Nehru colony
garbage-1 is full!
Kindly empty the
garbage in Nehru colony
Subject
Text Me...

5.3 Discussion

The following are the results which obtained from this work,

- Waste Level detection inside the dustbin.
- Transmit the information wirelessly to concerned.
- The data can be accessed anytime and from anywhere.
- The real-time data transmission and access.
- Avoids the overflows of Dustbins.

This IoT based waste management is very useful for smart cities in different aspects. We have seen that, in cities there are different dustbins located in the different area's and dustbins get over flown many times and the concerned people do not get information about this. Our system is designed to solve this issue and will provide complete details of the dustbin located in the different area's throughout the city. The concerned authority can access the information from anywhere and anytime to get the details. Accordingly they can take the decision on this immediately. As mentioned in the report, the main objective of the project is to monitor the garbage level, to sense whether the waste is wet or dry and to monitor if any garbage is spread outside the dustbin. The sensor collect the respective information and fed to the microcontroller (here ATMEGA328P), the microcontroller processes the information and with the help of GSM module, the information is sent to the authorized number present at the waste management centre over SMS. The entire experimental setup for the proposed system and the final SMS that is displayed on the phone screen is as shown in below snapshots.

5.4 Future Enhancement

There is a great scope for the modifications of the Smart Dustbin in future. The system can be improved by adding new functionalities. Dumping of the waste was manual in Smart dustbin this can be automated by fixing a robot arm or a tipper. The

path tracking can be GPS enabled and the dustbins can be monitored through a GUI. The Smart dustbins can be well widely used in the Smart buildings of Smart cities.

In this paper, implementation is done only for a single bin. Integration of many bins each with a unique ID can be done by implementing the principles of IOT and creating database for each bin which can be maintained by using SQL technology and a login webpage is created to ensure authorized entries. Apart from this, differentiation can be made between dry trash bin and wet trash bin collecting plastic dry waste and biodegradable waste respectively. To implement this methane and smell sensors can be used. This helps in distinguishing the waste at the source and hence reducing the requirement of manpower. To enhance it further, an automated system can be developed which is able to pick up waste in and around the bin, segregate them and put them in respective bins.

6. Conclusion

The process to intimate the central hub that the dustbin is full, it is discussed using Arduino Uno. Various features such as durability, affordability, prevention against damage and maintenance issues is kept in mind while designing the dustbin. Implementation these Smart Dustbins can prevent the accumulation of the garbage along the roadside to a great extent thereby controlling the widespread of many diseases. It can prevent pollution and also prevent the consumption of the spread out garbage by the street animals. This Smart Dustbin can contribute a lot towards a clean and hygienic environment in building a smart city.

Smart dustbins are the now the needs of Smart buildings. Smart waste monitoring and management is the keen idea of smart city planners. Smart dustbins is a new idea of implementation which makes a normal dustbin smart using sensors for garbage level detection and sending message to the user updating the status of the bin. As soon as the dustbin is full it moves in the predefined path to reach the larger container with the help of motors and wheels. The garbage is dumped to the container manually and the dustbin moves back in the same direction back to its initial place.

7. References

[1] M.T.H. Shubho, M.T Hassan, M.R. Hossain and M. N. Neema, “Quantitative Analysis of Spatial Pattern of Dustbins and its Pollution in Dhaka City--A GIS Based Approach”, Asian Transactions on Engineering (ATE ISSN: 2221-4267) vol. 03 Issue 04, September 2013, pp.1-7.

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[3] Narayan Sharma, Nirman Singha, Tanmoy Dutta, “Smart Bin Implementation for Smart Cities”, International Journal of Scientific & Engineering Research, Volume 6, Issue 9, September-2015, pp.787-791.

[4] Prof. R.M.Sahu, Akshay Godase, Pramod Shinde, Reshma Shinde, “Garbage and Street Light Monitoring System Using Internet of Things”, International journal of innovative research in electrical, electronics, instrumentation and control engineering Vol. 4, Issue 4, April 2016

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[6]Prof. R.M.Sahu, Akshay Godase, Pramod Shinde, Reshma Shinde, “Garbage and Street Light Monitoring System Using Internet of Things”, International journal of innovative research in electrical, electronics, instrumentation and control engineering Vol. 4, Issue 4, April 2016

[7]K. Vidyasagar, M. Sumalatha, K. Swathi and M. Rambabu, “Eco-friendly Environment with RFID Communication Imparted Waste Collecting Robot”, Journal of Academia and Industrial Research (JAIR) Volume 4, Issue 2 July 2015, pp 43- 47.